

REMARKS

The Office Action of June 19, 2006 has been reviewed and the Examiner's comments carefully considered. Claims 1, 2 and 7-9 have been amended hereinabove. No new matter has been added. Support for these amendments can be found in the specification and drawings as originally filed. In addition, the specification has been amended to correct minor typographical errors. The Examiner has now finalized his restriction requirement set forth in the Office Action of March 27, 2006 and withdrawn claims 3-6 from further consideration. The Applicants explicitly reserve the right to file a divisional application directed to the non-elected claims. Accordingly, claims 1, 2 and 7-12 were examined on their merit in this application, and claims 1, 2 and 9 are in independent form.

Information Disclosure Statement

The Form PTO/SB/08a initialed by the Examiner and returned with the Office Action shows that the Examiner has not provided his initials next to JP 08-125344. Applicants enclose herewith another copy of our timely-filed Form PTO/SB/08a and request that the Examiner provide his initials next to JP 08-125344 and return the initialed copy of Form PTO/SB/08a indicating such consideration. A copy of JP 08-125344 is enclosed herewith for the Examiner's convenience.

35 U.S.C. §112 Rejections, Second Paragraph

Claims 1, 2 and 7-12 stand rejected under 35 U.S.C. §112, second paragraph, as being unclear, vague and indefinite. Specifically, the Examiner contends that it is not understood how the Applicants can provide a metal chip and after a punching step have metal remaining in a die hole.

The Applicants believe that the above amendments to claims 1, 2 and 7-9 overcome the Examiner's indefiniteness rejections. Specifically, claims 1 and 9 have been amended to clarify that a punch penetrates a conductive metal sheet but does not reach a resin sheet and a chip from the conductive metal sheet punches a hole in the resin sheet such that the chip is inserted and remains in the through hole. Claim 2 has been amended to clarify that a punch penetrates a conductive metal sheet but does not reach a resin sheet having a

through hole and the chip is inserted and remains in the through hole. Support for these amendments can be found on page 42, lines 1-10 of the Applicants' specification.

Therefore, reconsideration and withdrawal of these rejections are respectfully requested.

35 U.S.C. §103 Rejections

Claims 1, 2 and 7-12 stand rejected under 35 U.S.C. §103(a) for obviousness based upon United States Patent No. 3,750,278 to Baker et al. (hereinafter "the Baker patent") in view of United States Patent No. 6,308,406 to Gill et al. (hereinafter "the Gill patent"). In view of the above amendments and the following remarks, the Applicants respectfully request reconsideration of this rejection.

As defined by independent claim 1, the present invention is directed to a process for producing a collapsed filled via hole. The process includes the steps of: placing an insulating resin sheet with or without a conductive material sheet on at least one surface of the resin sheet, and a conductive metal sheet having a thickness larger than the resin sheet in this order on a die hole provided in a metal mold; punching the conductive metal sheet with a punch that does not reach the resin sheet thereby producing a chip of the conductive metal, the chip of conductive metal is pressed into the resin sheet by the punch, whereby a through hole is formed in the resin sheet and the chip is inserted and remains in the through hole to form a filled via hole with a first end and a second end; and collapsing the first end and the second end of the filled via hole to externally spread like an umbrella thereby producing the collapsed filled via hole. The chip of conductive metal protrudes from both surfaces of the resin sheet by 10 to 500 μm .

As defined by independent claim 2, the present invention is a process for producing a collapsed filled via hole. The process includes the steps of placing an insulating resin sheet with or without a conductive material sheet on at least one surface of the resin sheet having a through hole, and a conductive metal sheet having a thickness larger than the resin sheet in this order on a die hole provided in a metal mold; punching the conductive metal sheet with a punch of substantially the same size as the through hole and set over the position corresponding to the hole thereby producing a chip of the conductive metal, the chip of conductive metal is pressed into the resin sheet by the punch to form a filled via hole with

a first end and second end, whereby the chip is inserted and remains in the through hole and the punch does not reach the resin sheet; and collapsing the first end and the second end of the filled via hole to externally spread like an umbrella thereby producing the collapsed filled via hole. The chip of conductive metal protrudes from both surfaces of the resin sheet by 10 to 500 μm .

As defined by independent claim 9, the present invention is directed to a process for producing a collapsed filled via hole. The process includes the steps of: (A) placing an insulating resin sheet, optionally including a conductive material sheet on at least one surface of the resin sheet, in a die hole provided in a metal mold; (B) placing a conductive metal sheet having a thickness larger than the resin sheet in the die hole; (C) punching the metal sheet in (B) with a punch that does not reach the resin sheet thereby producing a chip of the metal sheet in (B), the chip of the metal sheet in (B) is pressed into the resin sheet in (A) by the punch, whereby a through hole is formed in the resin sheet in (A) and the chip is inserted and remains in the through hole to form a filled via hole with a first end and a second end; and (D) collapsing the first end and the second end of the filled via hole to externally spread like an umbrella thereby producing the collapsed filled via hole. The chip of conductive metal protrudes from both surfaces of the resin sheet by 10 to 500 μm .

The subject matter of independent claims 1, 2 and 9 has been amended to “a process for producing a collapsed filled via hole”. Support for these amendments can be found on page 59, lines 3-8, page 72, line 22 to page 73, line 1 and page 74, line 15 to page 76, line 2 of the Applicants’ specification. No new matter has been added by these amendments.

The Baker patent is directed to an apparatus for producing a printed circuit board with a through connection between conductors on opposite sides of the board. The through connection is provided by a conductive element press-fitted in a hole extending through the conductors and an insulating material of the circuit board. The conductive element is inserted into the board by punching a hole in the board at a predetermined receiving position, positioning conductive material between the retracted punch and the hole and positioning an anvil to enclose the hole on the side of the board opposite that facing the punch.

The Baker patent fails to teach or suggest several elements of independent claims 1, 2 and 9. Specifically, the Baker patent does not teach or suggest a process for producing a collapsed filled via hole. While the Baker patent discusses forming a through connection by press fitting a conductive element in a hole in a sheet of insulating material, this hole filled with a conductive element is not equivalent to a collapsed filled via hole. The Baker patent also fails to teach or suggest a step of collapsing a first end and a second end of the filled via hole to externally spread like an umbrella as required by amended independent claims 1, 2 and 9. As illustrated in Figs. 6-13 of the Baker patent, the through connection is provided by press fitting a conductive element in a hole in a sheet of insulating material. The step of collapsing the filled via hole is not discussed in the specification or illustrated in the figures of the Baker patent. Finally, independent claims 1, 2 and 9 require that the chip of conductive metal protrudes from both surfaces of the resin sheet by 10 to 500 μm . Such a feature is not taught or suggested by the Baker patent.

Furthermore, the Gill patent does not cure the deficiencies of the Baker patent. The Gill patent discloses a method for forming an electrical conductive circuit on a substrate. The conductive circuit is formed on a substrate that has a conductive layer and a cover layer bonded thereto. The conductive circuit is formed by the severing of the conductive layer into a conductive circuit using a cutting edge of a cutting tool. The Gill patent is provided by the Examiner as a teaching of inserting a conductive layer into a through hole such that the conductive layer remains in the through hole. The Gill patent does not teach or suggest a process for producing a collapsed filled via hole, collapsing a first end and a second end of the filled via hole to externally spread like an umbrella or that the chip of conductive metal protrudes from both surfaces of the resin sheet by 10 to 500 μm . Each of these features is required by amended independent claims 1, 2 and 9.

When evaluating a claim for determining the question of obviousness, all of the limitations of the claim must be evaluated. Where claimed limitations are simply not present in the prior art, a *prima facie* obviousness rejection is not supported. Accordingly, since the combination of the Baker patent and the Gill patent fail to teach or suggest several limitations of amended independent claims 1, 2 and 9, a *prima facie* case of obviousness has not been established.

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For the foregoing reasons, the Applicants believe that the subject matter of amended independent claims 1, 2 and 9 is not rendered obvious by the Baker patent in view of the Gill patent. Reconsideration and withdrawal of the rejection of claims 1, 2 and 9 are respectfully requested.

Claims 7, 8 and 10-12 depend from and add further limitations to amended independent claims 1, 2 and 9 and are believed to be patentable for the reasons discussed hereinabove in connection with amended independent claims 1, 2 and 9. Reconsideration and withdrawal of the rejections of claims 1, 2 and 9 are respectfully requested.

Based on the foregoing amendments and remarks, reconsideration of the rejections and allowance of pending claims 1, 2 and 7-12 are respectfully requested.

Respectfully submitted,

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